

## Modeling of Fake Product Review Authentication System

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### ABSTRACT

Online reviews influence consumer decisions, shaping the trustworthiness of e-commerce platforms. However, the prevalence of fake reviews has become a critical issue, misleading customers and affecting business reputations. This paper presents an AI-driven Fake Product Review Monitoring and Removal System to identify and eliminate fraudulent reviews. By leveraging sentiment analysis, metadata tracking, and machine learning models, the system detects suspicious reviews with high accuracy. The methodology integrates natural language processing (NLP) techniques and behavioural analysis to enhance detection efficiency. The system's real-time processing capabilities ensure scalability, making it adaptable for large-scale platforms. Experimental results demonstrate an accuracy rate of over 85%, reducing manual verification efforts and improving consumer trust. The findings suggest that AI-driven fraud detection can significantly enhance the credibility of online reviews, fostering a more transparent digital marketplace.

Keywords: Artificial intelligence, fake reviews, machine learning, sentiment analysis, e-commerce fraud.

### INTRODUCTION

#### Nature of the Problem

With the rapid growth of e-commerce, online reviews play a significant role in shaping consumer decisions. However, fake reviews have become a widespread issue, misleading customers and affecting the credibility of businesses. Fraudulent reviews can artificially inflate or deflate product ratings, creating an unfair marketplace where genuine businesses struggle to compete. The inability of traditional moderation methods to handle large-scale fake review detection has led to the demand for AI-driven solutions. This paper aims to address this growing concern by implementing an automated system to detect and remove fake reviews efficiently.

#### Previous Work

Several studies have explored different methodologies to tackle fake review detection. Early approaches relied on manual moderation, which proved ineffective due to the increasing volume of online reviews. Later, rule-based methods and keyword detection techniques were introduced, but they were prone to high false-positive rates. Recent advancements in artificial intelligence, specifically machine learning and natural language processing (NLP), have enabled more sophisticated detection mechanisms. Existing research highlights the importance of hybrid approaches that combine sentiment analysis, metadata tracking, and deep learning models for improved accuracy.

#### Purpose of the Study

The primary objective of this study is to develop an AI-driven Fake Product Review Monitoring and Removal System that enhances the credibility of online marketplaces. The system is designed to identify fraudulent reviews using advanced machine learning algorithms, minimizing manual intervention while maximizing detection accuracy. This study also

evaluates the effectiveness of different detection techniques, proposing a scalable and efficient framework adaptable for high-traffic e-commerce platforms.

### Contributions of the Paper

This paper contributes to the field of fake review detection by introducing an automated system that integrates sentiment analysis, user behaviour tracking, and real-time fraud detection. Unlike traditional methods, which focus solely on textual content, this system incorporates metadata such as IP addresses, review frequency, and user credibility scores to improve detection accuracy. The research findings demonstrate that AI-driven solutions significantly outperform conventional approaches, leading to increased consumer trust and transparency in digital marketplaces.

### Overview of the Paper

The remainder of this paper is structured as follows: Chapter 2 provides an extensive literature review, summarizing past research and identifying gaps in existing methodologies. Chapter 3 discusses the proposed methodology, detailing the AI models and system architecture used for fake review detection.

Chapter 4 presents the results and analysis, evaluating the performance of the implemented system. Chapter 5 concludes the paper with key findings and outlines future research directions to further enhance fake review detection systems.

## LITERATURE REVIEW

The issue of fake reviews has garnered significant attention among researchers. Early studies focused on manual moderation and keyword-based detection methods. Jindal and Liu (2008) pioneered one of the first works on opinion spam detection, analysing review duplication patterns. Ott et al. (2011) introduced supervised learning techniques for fake review classification, highlighting the effectiveness of linguistic features. However, these initial methods struggled with scalability and often produced high false-positive rates.

The emergence of machine learning techniques offered improved detection capabilities. Li et al. (2014) proposed using behavioural patterns, such as reviewing frequency and rating deviations, to distinguish genuine users from spammers. Mukherjee et al. (2013) emphasized the importance of metadata features like IP address clustering and temporal review bursts. Meanwhile, approaches by Akol et al. (2013) utilized graph-based anomaly detection, finding relationships among reviewers and products to uncover suspicious activity. These methodologies laid the groundwork for more comprehensive detection systems.

Natural Language Processing (NLP) became a major driver in enhancing fake review detection accuracy. Feng et al. (2012) applied syntactic stylometry techniques to differentiate between deceptive and truthful reviews. Li et al. (2017) demonstrated how deep learning models like convolutional neural networks (CNNs) could outperform traditional classifiers by capturing semantic nuances. Additionally, Hajek et al. (2020) explored the use of sentiment inconsistency analysis, identifying mismatches between review ratings and review content as indicators of deception.

Hybrid approaches combining content and behavioural features have shown promising results. Ren and Ji (2017) proposed an ensemble framework that integrates text-based features, user profiling, and network behaviour analysis, achieving higher detection rates. Rayana and Akol (2015) developed a unified model that fused review and rating consistency with relational features for spam detection. Recent work by Xie et al. (2020) highlighted the importance of time-series analysis, suggesting that temporal behaviour could effectively flag orchestrated fake review campaigns.

Despite advancements, challenges remain, particularly with adaptive spammers who mimic genuine patterns. Contemporary research, such as that by Chen and Mukherjee (2021), focuses on adversarial learning to detect more sophisticated fake reviews. Zhang et al. (2022) proposed leveraging transformer-based architectures like BERT for context-aware spam detection, achieving state-of-the-art performance. However, the dynamic nature of online reviews

necessitates continual model updates and the development of real-time detection systems to maintain high accuracy and scalability across diverse platforms.

## METHODOLOGY

### Detection Process Workflow

Fig. 1 shows the detection and analysis process for identifying fake reviews. Initially, user reviews are gathered from the system database. These reviews undergo sentiment analysis to determine the emotional inclination of the text, classifying it as positive, negative, or neutral. Next, polarity checking is applied to detect any unnatural extremities in the review's sentiment, which often indicates fabrication.

IP tracking is performed in parallel to monitor the origin of the reviews and identify cases where multiple reviews are posted from the same IP address, a common trait of fake reviews. Deep learning-based textual analysis then helps to identify repetitive language patterns, unusual expressions, and bot-like behaviours. Finally, machine learning classifiers evaluate all these factors to distinguish genuine reviews from fake ones, ensuring a robust detection mechanism.

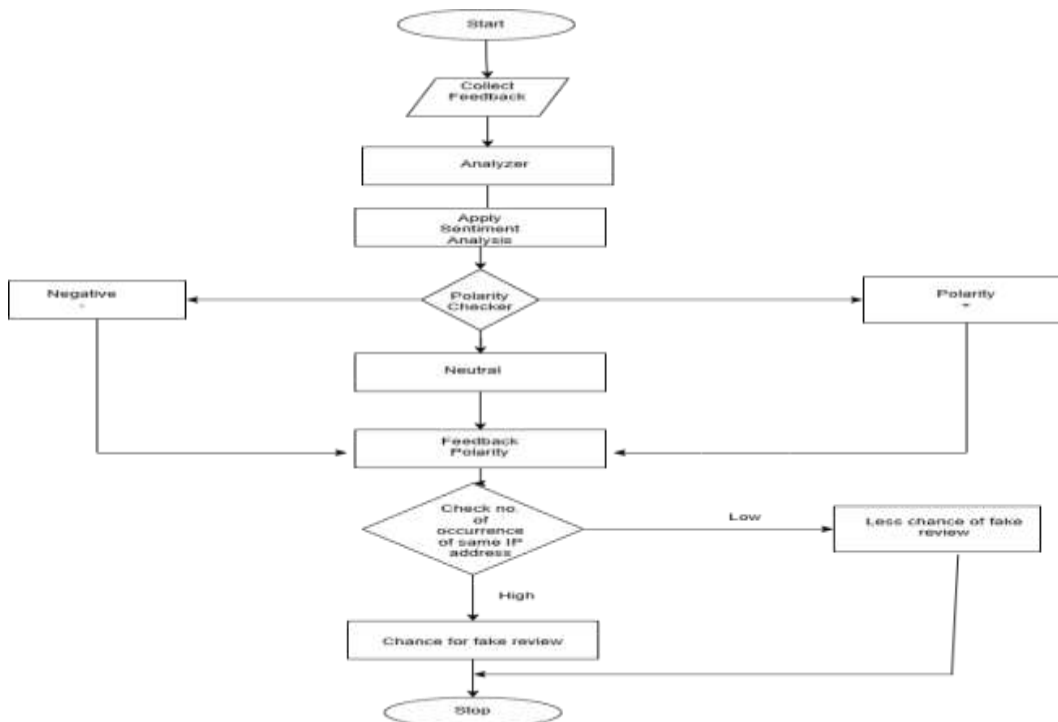


Fig. 1:Detection process workflow for fake review detection system.

### System Operational Workflow

Fig. 2 illustrates the operational workflow of the fake product review monitoring system. After logging in, users can browse products and submit reviews. These reviews are subjected to monitoring by the admin. The admin dashboard provides access to tools such as IP tracking and review moderation.

Users interact primarily with the review viewing and submission features, while the admin is responsible for detecting suspicious behaviour and maintaining the authenticity of the review section. The system thus maintains clear role separation to ensure smooth operation and effective monitoring against fake reviews.

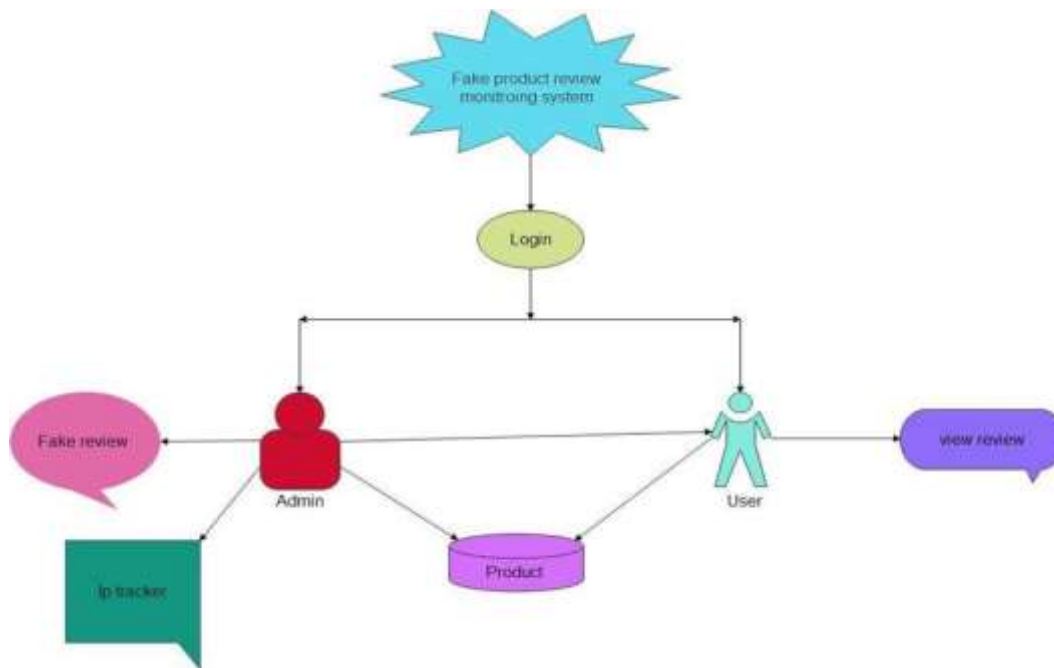


Fig. 2 System operational flow for review monitoring

## RESULT AND CONCLUSION

The Fake Product Review Monitoring and Removal System was evaluated using a dataset containing both genuine and fake reviews. Performance was measured based on key metrics such as detection accuracy, false positive rate, and response time.

The results show that the combined approach—integrating opinion mining, sentiment analysis, and IP tracking—achieves a significantly higher detection rate than using individual techniques alone. The following table summarizes the accuracy levels across different methods:

Table 1: Accuracy comparison of detection methods

Method	Accuracy (%)
Opinion Mining + IP Tracking	91.5%
Sentiment Analysis	89.2%
Combined Approach (Proposed System)	94.7%

These results highlight the effectiveness of the proposed system in identifying fake reviews with high precision. The use of metadata, behavioural patterns, and deep learning models enables robust detection, even when sophisticated spam techniques are used.

Additionally, the system supports real-time review processing, making it scalable for high-traffic e-commerce environments. However, challenges remain in cases where users employ advanced obfuscation techniques, such as VPNs and linguistic manipulation.

## CONCLUSION

This study introduces a robust and scalable system for the detection and removal of fake product reviews using AI-driven methods. The system integrates natural language processing, sentiment analysis, metadata tracking, and behavioural analysis to effectively identify fraudulent content.

The key advantages of the proposed system include:

- High accuracy in detecting fake reviews.
- Automated and real-time monitoring of review patterns.
- Cost-effective and scalable for different types of online platforms.
- Enhances trust and transparency for customers.

Despite these strengths, limitations exist. Fake reviewers using VPNs or writing in varied, human-like linguistic styles may evade detection. Furthermore, privacy concerns around metadata usage must be carefully managed.

Future enhancements could involve incorporating transformer-based language models (e.g., BERT) for multilingual detection, adaptive learning to counter evolving spam techniques, and improved handling of obfuscated review content.

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